International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(6): 2186-2189

Received: 01-09-2018
Accepted: 05-10-2018

Humajahan SV
Dept. of fruit science, University of Horticultural Sciences, Bagalkot, Karnataka, India

Patil DR
Professor of Fruit Science and ADRE, MHREC UHS, Bagalkot, Karnataka, India

Patil SN
Assistant. Prof. (Fruit Science), Dept. of Fruit Science, College of Horticulture, Bagalkot University of Horticultural sciences, Bagalkot, Karnataka, India

Venkateshalu
Assistant. Prof. (Fruit Science), Dept. of Fruit Science, College of Horticulture, Bagalkot University of Horticultural sciences, Bagalkot, Karnataka, India

Reddi SG
Asst. Professor (Agronomy), AICRP on palms (Oil palm), ARS Campus, Kanakagiri Road, Gangavathi, Karnataka, India

DS Ambika
Asst. Professor, Dept. of Plant Pathology, COH, Bagalkot, Karnataka, India

Correspondence
Humajahan SV
Dept. of fruit science, University of Horticultural Sciences, Bagalkot, Karnataka, India

Effect of fertigation on growth and yield of banana cv. Red banana (Musa AAA)

Humajahan SV, Patil DR, Patil SN, Venkateshalu, Reddi SG and DS Ambika

Abstract
Banana is a fast growing plant that requires high and continuous nutrient and water supply for year long sustainer and ensures economically high yield. These nutrients may be partly supplied by the soil, but fertigation is generally needed to satisfy the needs of the plant and to obtain profitable production. This study was conducted to determine the fertigation on growth and yield of banana cv. Red banana at Fruit Orchard, Sector 70, University of Horticultural Sciences, Bagalkot. Fertigation in comparison to soil application was studied. The banana under fertigation system performed good in growth and yield in comparison with soil application. There were eight levels of treatments and 20 kg FYM was common for all the 8 treatments. The experimental design was laid out in Randomized Block Design (RBD) with three replications with five plants per replication. The maximum pseudostem height at shooting was recorded in plants treated with 100 per cent RDF through fertigation in eight equal splits at fortnightly interval (2.18 m) followed by 75 per cent RDF through fertigation in eight equal splits at fortnightly interval (2.08 m) than in surface irrigation with 100% RDF through soil application in four equal splits at monthly interval (1.54 m), early shooting was recorded in treatment 100 per cent RDF through fertigation in eight equal splits at fortnightly interval (296.17 days), highest pseudostem girth (68.08 cm) and crop duration was lowest (387.41 days) in 100 per cent RDF through fertigation in eight equal splits at fortnightly interval. However, highest bunch weight (8.30 kg) and maximum yield (22.84 t/ha) was obtained in 100 per cent RDF through fertigation in eight equal splits at fortnightly interval. Followed by 75 per cent RDF through fertigation in eight equal splits at fortnightly interval (22.23 t/ha).

Keywords: growth, fertigation, RDF-recommended dose of fertilizers, yield, red banana

Introduction
Banana and plantain (*Musa* spp.) commonly called banana, is an important world food crop that is far more important to food security and livelihoods of millions of smallholders in tropical countries of Africa, Asia and South/Central America than its western image of an industrial export fruit would suggest. Red banana has been declared as GI (geographical indication crop). In Karnataka Red banana is grown in Bidar, Sirsi, Kamalapur and some Kaveri belt region. There is a high demand for exporting this cultivar. Presently, Red banana is gaining popularity due to its medicinal values such as kidney stones remedy, but the yields are moderate due to lack of proper nutrient and water management. Presently, Banana contains area of 852.00 ('000 Ha), production of 30275.00 ('000 MT), productivity of 37.0 (MT/ Ha) in India. Whereas, 102.71 ('000 Ha) area, production of 2675.63 ('000 MT) and productivity of 26.10 (MT/ Ha) was recorded in Karnataka. Fertigation has vast potential in improving nutrient use efficiency, saving labour towards weeding, energy in application, reducing the cost of production and helps in maintaining the soil health besides to meet the specific nutritional requirements of the crop (Holder and Gimbs, 1983) [5]. Fertigation is a technique that combines irrigation with fertilization through any micro irrigation system especially through drip irrigation. Fertigation could bring about an accurate control of water and nutrients in the immediate vicinity of the root system. Hence, it is easy and efficient to fertilize the crop and prevents fertilizer contamination of ground water through leaching below the crop root zone (Hagin and Lowengart, 1996) [3]. Very few fertigation studies were carried out in banana mainly in Israel (Lahav *et al*., 1982; Lahav and Kalmar, 1995) [6, 7] and South Africa (Smith and Hoffman, 1998) [10]. Research work on fertigation in banana is very meagre in India. Keeping all the above points in view, a study was conducted with the objective to know the effect of fertigation on the growth and yield of the banana cv. Red banana.

Materials and Methods

Tissue cultured red banana seedlings were planted at the spacing of 1.8 × 1.8 m in pits of 45 × 45 × 45 cm. The drip irrigation system was designed in an experimental site. It consisted of 50 mm PVC (Poly Vinyl Chloride) valve drip pipes which were connected in series with filter in drip irrigation tank. The main PVC line was of 50 mm diameter, to which a sub-main was connected. Lateral lines were drawn from the sub mains parallel to the plant rows. Emitter with a discharge rate of four liters per hour was fixed on one side of the plant and each lateral line was terminated with the end plug. The required quantity of fertilizers were applied as per the programme of research. Fertilizer application started three months after planting. N was applied in the form of urea, phosphorous was applied in the form of Di ammonium Phosphate (DAP) and potassuim in the form of Muriate of Potash (MOP) in T1, T2, T3, T4 and T8 while phosphorous was applied in the form of single super phosphate in T5, T6 and T8.

100% RDF (200:100:300 g/plant) through soil application in 4 equal splits at monthly interval (T1). 100% RDF through fertigation in 8 equal splits at fortnightly interval (T2). 75% RDF through fertigation in 8 equal splits at fortnightly interval (T3). 50% RDF through fertigation in 8 equal splits at fortnightly interval (T4). 100% RDF i.e N and K through fertigation in 8 equal splits at fortnightly interval and P as soil application in 4 equal splits at monthly interval (T5). 75% RDF i.e N and K through fertigation in 8 equal splits at fortnightly interval and P as soil application in 4 equal splits at monthly interval (T6). 50% RDF i.e N and K through fertigation in 8 equal splits at fortnightly interval and P as soil application in 4 equal splits at monthly interval (T7). 100% RDF i.e N through fertigation in 8 equal splits at fortnightly interval and P, K as soil application in 4 equal splits at monthly interval (T8).

Fertigation treatment details

T1 – 100% RDF i.e N-200g, P-100g and K 300g through soil application. (350 g urea, 217 g DAP 500 g MOP per plant).

T2 – 100% RDF i.e N-200g, P-100g and K-300g through fertigation. (350 g urea, 217 g DAP 500 g MOP plant).

T3 – 75% RDF i.e N-150 g, P-75 g and K-225 g through fertigation. (163 g urea, 262 g DAP and 375 g MOP per plant).

T4 – 50% RDF i.e N-100 g, P-50 g and K-150 g through fertigation. (175 g urea, 109 g DAP and 250 g MOP per plant).

T5 – 100% RDF i.e N and K through fertigation (435 g urea and 500 g MOP), and P-through soil application (625 g SSP).

T6 – 75% RDF i.e N and K through fertigation (326 g urea and 375 g MOP), and P-through soil application (469 g SSP).

T7 – 50% RDF i.e N and K through fertigation (217 g urea and 250 g MOP) and P-through soil application (312 g SSP).

T8– 100% RDF i.e N through fertigation (434.8 g urea) and P, K-soil application (625 g SSP and 500 g MOP).

Results and Discussion

Pseudostem Height (m): At shooting, 100 per cent RDF through fertigation in eight equal splits at fortnightly interval had significantly higher pseudostem height (2.18 m) over all the treatments except 75 per cent of RDF through fertigation in eight equal splits at fortnightly interval (2.08 m) which was on par with 100 per cent RDF through fertigation. Lowest pseudostem height (1.54 m) was recorded in 100 per cent RDF through soil application fertigation in four equal splits at monthly interval which was on par with 100 per cent N through fertigation in eight equal splits at fortnightly interval and P, K as soil application fertigation in four equal splits at monthly interval (1.77 m). This is due to reduced loss of applied fertilizers by leaching and timely application of required nutrients as per the crop growth stage directly in the root zone of the plant and improving the fertilizers-use efficiency. These results are also in confirmation with Dinesh and Pandey (2008) [2] who reported that application of 75 per cent RDF + schedule-II in main and ratoon crops in cv. Rasthali (AAB- Pathkapoora). This might be due to the nutrients applied through soil application may not be available to the plants at different stages which might have resulted in lower pseudostem height.

Pseudostem Girth (cm): At shooting it was observed that 100 per cent RDF through fertigation in eight equal splits at fortnightly interval had highest psuedostem girth (68.08 cm) which was significantly superior over all the treatments except 75 per cent RDF through fertigation in eight equal splits at fortnightly interval (65.88 cm). Lowest pseudostem height was recorded in treatment 100 per cent RDF through soil application in four equal splits at monthly interval (51.57 cm) which was on par with 100 per cent N through fertigation in eight equal splits at fortnightly interval and P, K as soil application in four equal splits at monthly interval (56.67 cm). This may be due to amount of nitrogen and potash increased in the soil due to fertigation which help in the formation of complex nitrogenous substances such as proteins and amino acids which are the building blocks of tissues. Similar findings have also been reported by Santosh and Tiwari (2017). This may be due to low uptake of nutrients to the plants through conventional method.

Crop duration (days): The data showed that crop duration was differed among the treatments presented in Table 1. 100 per cent RDF through fertigation in eight equal splits at fortnightly interval gave minimum plant duration (387.41 days) which was followed by 75 per cent RDF through fertigation in eight equal splits at fortnightly interval (397.22 days) and 50 per cent RDF through fertigation in eight equal splits at fortnightly interval (415.22 days), maximum plant duration of (518.94 days) was observed with 100 per cent RDF through soil application in four equal splits at monthly interval. Crop duration was least recorded in 100 per cent RDF through fertigation in eight equal splits at fortnightly interval (387.41 days) compared to 100 per cent RDF through soil application in four equal splits at monthly interval (518.94 days). Application of nutrients through fertigation reduced the crop duration in the present investigation. This might be due to the optimum quantity of available nutrients through fertigation hastened the process of initiation and emergence of inflorescence due to earlier production of leaves and better disposition of photosynthetic activity resulting in higher required net assimilation. Similar results were recorded by Hazarika and Ansari (2010) with the reason due to the higher net assimilation rate on account of better growth leading to the production of endogenous metabolites earlier in optimum level which enabled the early flower bud initiation and thereby early shooting.

Highest bunch weight (8.30 kg) were observed in 100 per cent RDF through fertigation followed by 75 per cent of RDF (7.92 kg) through fertigation in eight equal splits at fortnightly interval. 100 per cent RDF through soil application in four equal splits at monthly interval recorded lowest number of bunch weight (5.22 kg). From the data (Table 1, fig. 1), the level of fertigation has affected the bunch weight significantly. Application of fertilizers through soil application resulted into reduced bunch weight which may be due to low uptake of nutrients and also leaching of nutrients. These results are in conformity with the research findings of Berad (1996) [1] and Nalina et al. (2007) [8].

The significant difference was noticed among the treatments with respect to bunch yield in terms of kg/plant and bunch yield in terms of t/ha. 100 per cent RDF through fertigation in eight equal splits at fortnightly interval recorded maximum bunch yield (8.30 kg/ plant and 22.84 t/ ha) followed by 75 per cent RDF (150:75:225 g NPK/plant) through fertigation in eight equal splits at fortnightly interval (7.92 kg/plant and 22.23 t/ha) at the time of harvest. This highest yield was due to increase in length, weight of the finger, number of fingers per hand and weight of the bunch in 100 per cent RDF through fertigation in eight equal splits at fortnightly interval as compared to 100 per cent RDF through soil application in four equal splits at monthly interval.

This increase in yield may be due to improvement in the nutrient use efficiency of crops by timely application of judicious amounts of nutrients through fertigation directly to the crop root zone with reduction in N and K losses through leaching and percolation. Srinivas (1998) [11] also reported that highest yield with 100 g nitrogen applied through drip in Ney Poovan variety of banana. Similarly, Srinivas et al. (2001) [12] reported that fruit yield of banana cv. Robusta increased with increase in nitrogen and potassium fertigation up to 200 g/plant.

Table 1: Effect of fertigation on pseudostem height (m), pseudostem girth (cm), Crop duration (days), Weight of bunch (kg) and Yield (t/ha)

Treatment	Pseudostem height (m)	Pseudostem girth (cm)	Crop duration (days)	Weight of bunch (kg)	Yield (t/ ha)
T_1	1.54	51.57	518.00	5.22	12.84
T_2	2.18	68.09	387.41	8.30	22.84
T_3	2.08	65.88	397.22	7.92	22.23
T_4	2.07	57.34	415.22	7.36	20.50
T_5	2.06	57.00	448.51	7.02	19.05
T_6	1.92	56.73	498.25	6.35	18.78
T_7	1.94	59.40	459.61	5.93	14.00
T_8	1.77	56.67	491.54	5.42	14.09
S Em ±	0.13	3.36	19.01	0.41	0.81
CD at 5 %	0.38	10.18	57.66	1.23	2.48

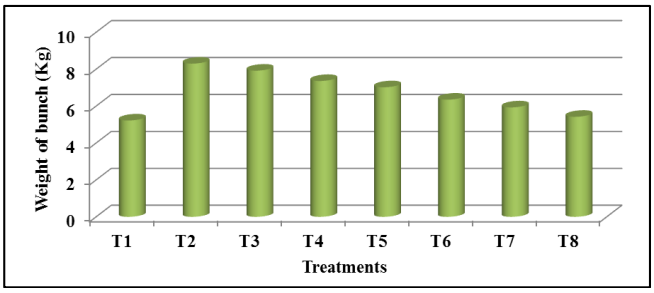

Fig 1: Effect of fertigation on weight of bunch of banana cv. Red banana (AAA)

Summary

Growth parameters like pseudostem height (m), pseudostem girth (cm), crop duration were studied, and it was recorded that plants supplied with 100 per cent RDF through fertigation in eight equal splits at fortnightly interval recorded highest values with respect to above parameters also yield and weight of the bunch were significantly influenced by fertigation. The maximum weight of bunch (8.30 kg) was recorded in plants supplied with 100 per cent RDF through fertigation in eight equal splits at fortnightly interval followed by 75 per cent RDF through fertigation in eight equal splits at fortnightly interval (7.92 kg). The minimum weight of bunch (5.22 kg) was recorded in 100 per cent RDF through soil application in four equal splits at monthly interval. The effect of fertigation on total yield per plant of banana cv. Red banana showed significant differences among the different treatments. The significantly highest bunch yield (22.84 t/ha) was obtained in 100 per cent RDF through fertigation in eight equal splits at fortnightly interval while, the minimum yield (12.84 t/ha) was obtained in 100 per cent RDF through soil application in four equal splits at monthly interval.

Conclusion

In the present investigation 100 per cent RDF through fertigation in eight equal splits at fortnightly interval in banana cv. Red banana resulted into higher yield (22.23 t/ha) and was on par with 75 per cent of RDF through fertigation in eight equal splits at fortnightly interval and saves 25 per cent of fertilizer without reducing the yield of banana. Further 100 per cent RDF through fertigation in eight equal splits at fortnightly interval resulted in better growth.

References

1. Berad SM, Shinde SH, Dahiwalkar SD. Effect of drip fertigation and paired planting on productivity and yield of banana. J. Maharashtra Agric. Univ. 1996; 23(3):288-290.
2. Dinesh K, Pandey V. Effect of fertigation on growth, yield and quality of banana 'Rasthali' (AAB-Pathkapoora) in coastal agro-climatic conditions of eastern India. Indian J. Agril. Sci. 2008; 78(9):798-800.
3. Hagin J, Lowengart A. Fertigation for minimizing environmental pollution by fertilizers. Asian. J. Hort. 1996; 4(2):5-7.
4. Hazarika BN, Ansari S. Effect of integrated nutrient management on growth and yield of banana cv. Jahaji. Indian J. Hort. 2010; 67(2):270-273.
5. Holder GD, Gimbs FA. Effects of nitrogen and irrigation on the growth and yield of banana. Trop Agric. Israeli. 1983; 68(4):331-334.
6. Lahav E, Kalmar D. Fertigation and water regimes on a banana plantation. Israel Inst. of Technol., Haifa, Israel. 1995; 14(6):25-33.
7. Lahav E, Turner DW, Weir R. The effect of the amount and form of nitrogen on the growth, yield and chemical

composition of the Williams banana. Int. Banana Nutri. 1982; 5:22-23.
8. Nalina L, Kumar K, Soorianthasundaram K, Jeyakumar P. Effect of different fertilizer levels on yield characters of plant and ratoon crop of tissue culture banana cv. Robusta (AAA). Int. J Tropical Agric. 2007; 25:(1-2).
9. Santosh DT, Tiwari KN. Response of tissue cultured banana cv. Grand Naine to different levels of nutrients under drip fertigation and black plastic mulch. App. Ecol. Envir. Res. 2017; 15(4):1473-1488.
10. Smith B, Hoffman E. Comparing drip and micro-spray fertigation. Weitropika Bulletin. 1998; 30:14-1.
11. Srinivas K. Growth, yield and quality of banana in relation to N fertigation. J trop. Agric. 1998; 74(4):260-264.
12. Srinivas K, Reddy BMC, Chandra Kumar S, Gowda ST, Raghupati HB, Padma P. Growth, yield and nutrient uptake of Robusta banana in relation to N and K fertigation. Indian J Hort. 2001; 58(4):287-293.